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LISTS OF SPECIES

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Annotated checklist of the birds (Aves) of Cerro Hoya National Park, Azuero Peninsula, Panamá

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Abstract: Protected only by the extreme ruggedness of its terrain, the montane regions of Cerro Hoya National Park are among the least biologically known regions of Central America. Here we provide a checklist of 225 bird species recorded from five expeditions to the region over the last 18 years, which represents lower species richness than many comparable areas in Panama and lower Central America. However, we recorded nine IUCN globally threatened species, three species with range extensions over 150 km to the southern Azuero Peninsula, and at least two previously unknown bird taxa. These facts suggest that our list of montane taxa from Cerro Hoya may be incomplete, and that this region represents one of the most important—and neglected—protected areas in Panama.

Key words: Mesoamerica, sky island, tropical seasonal dry forest, tropical montane forest, Los Santos

INTRODUCTION

The Azuero Peninsula, the largest north-south peninsula in Central America, is an 8,000 km² landmass that juts southward from the western Panamanian mainland. Considered the cultural and agricultural cradle of Panama, here—as in most of the Pacific forests of Central America—deforestation began with Spanish colonization in the 16th century (Murphy and Lugo 1995), and increased sharply in the early 20th century (Heckadon-Moreno 2009). By the middle of the 20th century, roughly half of the lowlands of the Azuero Peninsula had been deforested, largely converted to cattle pasture (Wright and Samaniego 2008; Heckadon-Moreno 2009). Although, in its native state, the Azuero Peninsula should be nearly entirely forested (Wright and Samaniego 2008), today less than 15% is covered in mature forest, with perhaps another 20% covered in secondary forest. Of the remaining Azuero mature forest, most can be found in Cerro Hoya National Park and La Tronosa Forest Reserve (07.3° N, 080.6° W) found just to the east of Cerro Hoya National Park.

Cerro Hoya National Park (~ 07.4–07.2° N, 080.9–080.6° W; Figure 1) includes a mountainous region isolated from Panama's Central Cordillera by 150 km of extremely hot, seasonally dry, and deforested lowlands. Within Panama, these highlands have a geology that is unique to the Azuero and adjacent Soná Peninsulas, as they originated as oceanic volcanoes during the Early and Middle Eocene (56–41 Mya, Buch et al. 2011), and subsequently shifted northward into their current position. The southern Azuero region that includes the present day Cerro Hoya mountain range has been an emergent feature of the proto-isthmus and subsequent Isthmus of Panama since at least the late Eocene (> 38 Mya; Herrera et al. 2012). During glacial periods in the Pleistocene the temperature in the lowlands of Panama may have been as much as 5°C lower than at present, and some species of plants now confined to high montane areas occurred at much lower elevations (Piperno et al. 1990). The majority of montane flora and fauna found in the Cerro Hoya region probably dispersed from the Talamancan or Central Cordilleran highlands across lowland regions during such periods of lower temperatures.

The montane forests of Cerro Hoya remain one of the most poorly studied highland regions in all of Middle America. In 1925, R. Benson made a minor collection of birds in the central Azuero region, at Montuoso (~ 07.7° N, 080.9° W), north of Cerro Hoya National Park. However, the first major scientific expedition to the area was undertaken by Aldrich and Bole in 1932, who collected

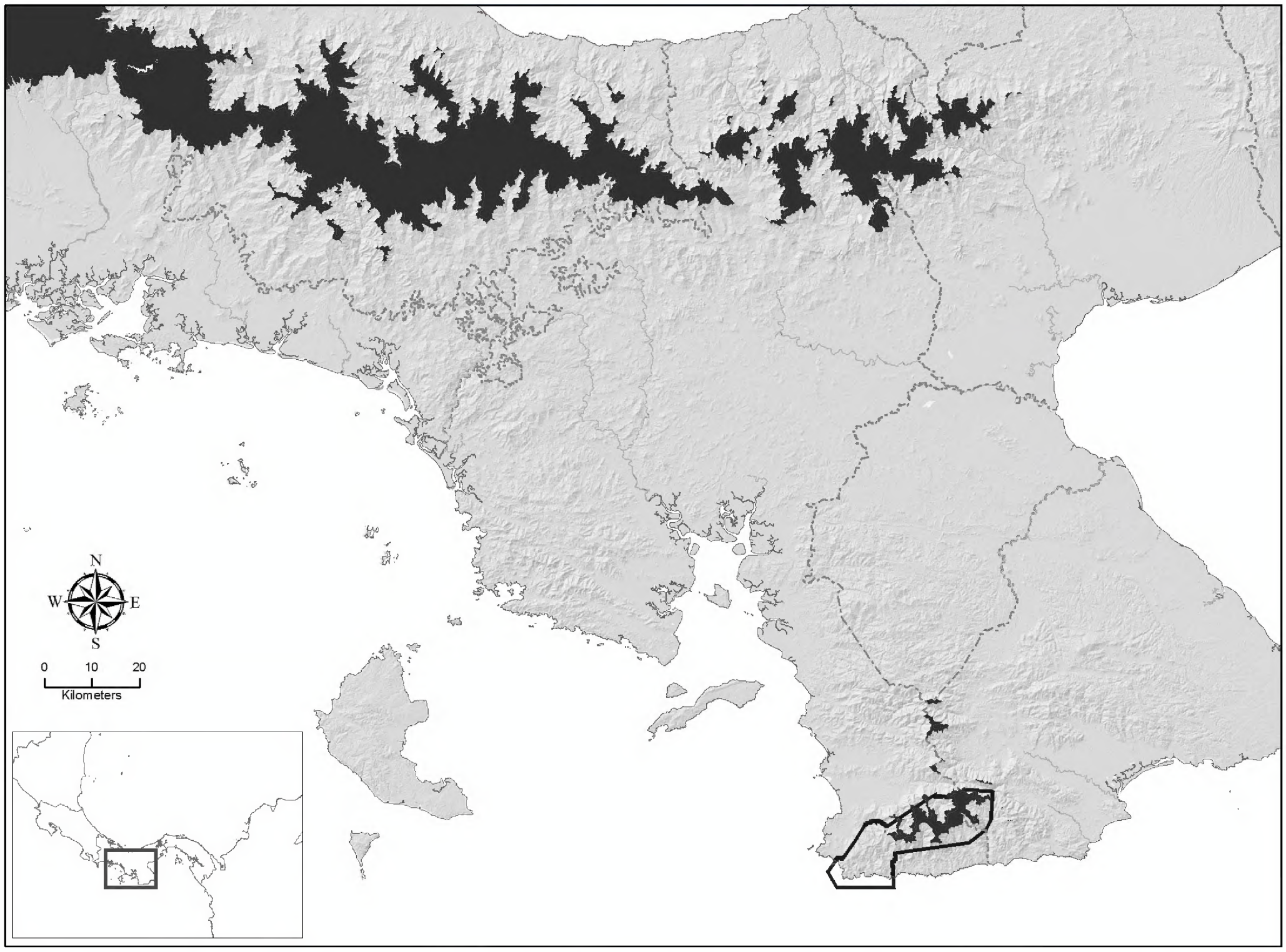

Figure 1. Map showing location of Cerro Hoya National Park and Azuero Peninsula relative to the central cordillera of western Panama. Darkened areas represent those montane areas above 950 m a.s.l. Only 77 km^2 of such habitat occur in Cerro Hoya National Park. With the exception of a few scattered montane patches just to the north, the Cerro Hoya highlands are separated by at least 150 km from the more extensive central and Talamanca highland ridge of Costa Rica and western Panama.

birds and mammals (Aldrich and Boyle 1937) in the lowlands northwest of Cerro Hoya National Park but did not explore the montane regions in the area. C.W. Myers provides the first detailed scientific description of the biota of the montane region surrounding Cerro Hoya (Myers 1962), crediting mammalogist C.O. Handley with providing him a hand-drawn map to the area. Based on his account, Myers managed to work above 1,200 m, but like Handley was unable to summit, and goes so far as to claim that the only known instance of a successful summit of the highest of the three peaks of Cerro Hoya was obtained by one of Aldrich and Bole's guides.

Interest in the avifauna of Cerro Hoya was rekindled at the end of the 20th century with the description of the Azuero Parakeet (*Pyrrhura picta eisenmanni* Delgado, 1985) by Delgado (1985)—who first suggested that the Cerro Hoya area was ornithologically the most poorly known region of Panama—and subsequently with the listing of Cerro Hoya National Park as an Important Bird Area for Panama (Angehr 2003). Here we provide an annotated checklist of the birds of the lowlands and highlands of the region based on the results of five ornithological expeditions to the region between 1996 and 2013.

MATERIALS AND METHODS

In February 1996, a team from the Philadelphia Academy of Natural Sciences (including GRA and RSR) made what is believed to be the first contemporary scientific collection focused on the highlands of Cerro Hoya. This expedition began on the coast at Cobachón (07.23° N, 080.64° W, this location and all subsequent named locations are mapped in Figure 2). (Note that on some maps of this region, e.g., Army Map Service 4037-I, "Horcones," several rivers are mislabeled. The town of Cobachón is shown to be at the mouth of the river labeled "Quebrada Punta Blanca" on this map. A smaller river about 4.5 km to the west is labeled "Río Cobachón". Because of these map errors, the location of Cobachón is incorrectly stated in Siegel and Olsen [2008]). The expedition ascended on horseback to a base camp at 650 m above sea level (a.s.l.) at Cascajilloso (07.28° N, 080.72° W),

Figure 2. Map showing specific locations visited during the five expeditions described in the text.

where the team worked for three days. On 20 February, GRA ascended to a nearby peak at 1,380 m a.s.l. on foot. Trip dates: 16–22 February 1996.

In 2004 a team from the Marjorie Barrick Museum and STRI (including MJM and JK) visited the lowlands just inside the park boundary near Restingue (07.24° N, 080.90° W), southern Veraguas. The goal of this trip was to collect representative lowland bird species as part of a more comprehensive survey of the birds of Panama, rather than to create a comprehensive survey of the avian diversity in Cerro Hoya, and therefore we only report those bird species collected as museum vouchers during that trip. Records from this trip are included here because they represent important records for the southern dry forest lowlands of the park area. Trip dates: 6–8 March 2004.

In 2009, ECC, a professional birding guide in Panama, spent one month observing birds in Cerro Hoya National Park, accompanied by J.P. Ríos. They entered the area by boat from Cambutal into Cobachón, making a base camp in the Cobachón valley at approximately 300 m a.s.l. Towards the end of the expedition, they climbed above an estimated 750 m a.s.l. to observe montane taxa. As well as the 2004 expedition, this expedition provides important records of the lowland avifauna in the southern region of the park. Trip dates: 1–31 July 2009.

The 2011 trip represents the only attempted ornithological expedition to the Cerro Hoya highlands during the rainy season. During this trip, more time was spent getting into and out of the basecamp than working at the site, which testifies to the difficulty of highland access on Cerro Hoya. This expedition departed on foot from El Cortezo (07.43° N, 080.63° W) and made base camp in an area known as La Bajía (07.34° N, 080.66° W). Trip dates: 24–28 June 2011.

A STRIBC team (including MJM and DBR) returned in April 2013 to collect additional specimens and to sample more highland taxa. This trip began on foot from La Provincia (07.38° N, 080.67° W) and established a base camp at 450 m a.s.l. in an area known locally as Pavo (07.33° N, 080.70° W), above the Río Pavo. During this expedition, mistnets were deployed primarily at the forested edge of the highest pasture above Pavo (750 m a.s.l.), although daily shotgun collecting trips occurred between 950 and 1,375 m a.s.l. Trip dates: 3–7 April 2013.

Specimens were legally collected under the following permits: 1996 Panama Audubon Important Bird Areas scientific collecting permit INRENARE 7-96; 2004: the STRI annual collecting permit DNPN-01-2004 (JK and MJM subpermittees); STRIBC 2011: SE/A-137-10 (Notif: DAPVS-0628-11); STRI BC 2013: SE/A-74-12.

English and scientific names follow the AOU Checklist (American Ornithologists' Union [AOU] 1998) through the 2013 supplement (Chesser et al. 2013).

RESULTS

We recorded a total of 225 confirmed bird species, with one additional hummingbird taxon (*Selasphorus sp.*) questionable. This includes nine species on the Red List of globally threatened bird species (IUCN 2013), including one Endangered, four Vulnerable, and four Near-Threatened species (Table 1). We recorded only 27 Nearctic–Neotropical migratory species, and only 10 species that could be considered primarily montane species (Angehr 2006). Based on the range maps in Angehr and Dean (2010), four species in our checklist were previously unknown from the Azuero Peninsula and represent range extensions of approximately 150 km. Below we provide details on 16 species of special interest.

Accounts of Species of Interest

Great Curassow (*Crax rubra* Linnaeus, 1758). At least one female was photographed by remote camera traps installed by J. Fort and colleagues to measure large mammal populations on Cerro Hoya. Two photographic instances occurred (8 and 10 March 2012), both showing a female curassow above Pavo at 785 m a.s.l. at 07.32° N, 080.70° W. Additionally, a female crown comb from a hunted curassow, killed by the owner, was on display at our field shelter in Pavo in 2013. Great Curassow are considered globally Vulnerable (IUCN 2013) and although were likely once widespread in Panama, are now only regularly observed in Darien National Park in extreme eastern Panama.

Brown-backed Dove (*Leptotila battyi* [Rothschild, 1901]). Although endemic to both the southern Azuero Peninsula and Coiba Island, where it is much more common, it is virtually unknown from continental Panama, except for Cerro Hoya National Park, where it is apparently rare.

Azuero (Painted) Parakeet (*Pyrrhura picta eisenmanni* Delgado, 1985). Although this species is treated by the AOU (1998, 2013) as a subspecies, many authorities consider it as a species (e.g., Angehr 2003; Angehr and

Table 1. Checklist of bird species, IUCN status, and collection/observation details from five ornithological expeditions to Cerro Hoya National Park.

Scientific Name	BirdLife global status	Montane obligate[1]	Migrants	Range extension[2]	1996 Cobachón - Cascajilloso	2004 Restingue	2009 Cobachón	2011 La Bajia	2013 Pavo	voucher specimen number
Tinamus major (Gmelin,1789)	NT				h		x		h	
Crypturellus soui (Hermann, 1783)					c		x		h	ANSP 187533
Dendrocygna autumnalis (Linnaeus, 1758)							x			
Cairina moschata (Linnaeus, 1758)							x			
Ortalis cinereiceps Gray, 1867					s		x		s	
Penelope purpurascens Wagler, 1830					s		x		s	
Crax rubra Linnaeus, 1758	VU								*	
Colinus cristatus (Linnaeus, 1766)							x			
Fregata magnificens Mathews, 1914					s		x			
Phalacrocorax brasilianus (Gmelin, 1789)					s		x			
Pelecanus occidentalis Linnaeus, 1766					s		x			
Tigrisoma mexicanum Swainson, 1834						c	x			
Ardea herodias Linnaeus, 1758					s					
Ardea alba Linnaeus, 1758							x			
Egretta caerulea (Linnaeus, 1758)					s					
Bubulcus ibis (Linnaeus, 1758)							x		s	
Butorides virescens (Linnaeus, 1758)							x			
Butorides sp.									s	
Cochlearius cochlearius (Linnaeus, 1766)							x			
Coragyps atratus (Bechstein, 1793)					s		x		s	
Cathartes aura (Linnaeus, 1758)					s		x		s	
Sarcoramphus papa (Linnaeus, 1758)					s		x		s	
Pandion haliaetus (Linnaeus, 1758)					s		x			
Chondrohierax uncinatus (Temminck, 1822)							x			
Elanoides forficatus (Linnaeus, 1758)					s				s	
Elanus leucurus (Vieillot, 1818)					c		x			ANSP 189194
Accipiter striatus Vieillot, 1818					s					
Buteogallus anthracinus (Deppe, 1830)							x			
Buteogallus urubitinga (Gmelin, 1788)					s					
Pseudastor albicollis (Latham, 1790)					s		x		s	
Buteo platypterus (Vieillot, 1823)			m		s				s	
Buteo nitidus (Latham, 1790)							x			
Buteo brachyurus Vieillot, 1816					s		x			
Buteo albicaudatus Vieillot, 1816					s					
Buteo albonotatus Kaup, 1847							x			
Spizaetus ornatus (Daudin, 1800)	NT				h		x			
Aramides cajaneus (Müller, 1776)							x			
Vanellus chilensis (Molina, 1782)						c	x			
Charadrius collaris Vieillot, 1818					s					
Jacana jacana (Linnaeus, 1766)							x			
Actitis macularius (Linnaeus, 1766)					s		x			
Leucophaeus atricilla (Linnaeus, 1758)					s					

Continued

Table 1. *Continued.*

Scientific Name	BirdLife global status	Montane obligate[1]	Migrants	Range extension[2]	1996 Cobachón - Cascajilloso	2004 Restingue	2009 Cobachón	2011 La Bajia	2013 Pavo	voucher specimen number
Thalasseus maximus (Boddaert, 1783)					s					
Thalasseus sandvicensis (Latham, 1787)					s					
Sterna hirundo Linnaeus, 1758					s					
Patagioenas speciosa (Gmelin, 1789)					s		x			
Columbina minuta (Linnaeus, 1766)							x			
Columbina talpacoti (Temminck, 1810)					s		x			
Claravis pretiosa (Ferrari-Pérez, 1886)					h		x			
Leptotila verreauxi (Bonaparte, 1855)					s		x		s	
Leptotila battyi (Rothschild, 1901)	VU				s		x			
Geotrygon montana (Linnaeus, 1758)									c	STRIBC 4646
Piaya cayana (Linnaeus, 1766)					s		x		s	
Tapera naevia (Linnaeus, 1766)					h		x		h	
Crotophaga sulcirostris Swainson 1827					s		x		s	
Tyto alba (Scopoli, 1769)					h					
Pulsatrix perspicillata (Latham, 1790)					h					
Glaucidium brasilianum (Gmelin, 1788)					s		x			
Ciccaba virgata (Cassin, 1849)					h				h	
Ciccaba nigrolineata (Sclater, 1859)		X			h					
Nyctidromus albicollis (Gmelin, 1789)					h	c	x		s	
Streptoprocne zonaris (Cabanis, 1862)					s		x		s	
Chaetura vauxi (Townsend, 1839)					s		x			
Phaethornis striigularis Gould, 1854					s		x		c	STRIBC 4656
Heliothryx barroti (Boucier, 1843)					s		x		s	
Heliomaster longirostris (Audebert & Vieillot, 1801)									c	STRIBC 4598
Lampornis sp. nov.		X						c	c	STRIBC 3592, 3593, 4577, 4579, 4580, 4581 & MVUP 2672
Selasphorus ardens Salvin, 1870	VU	X			?					
Chlorostilbon assimilis Lawrence, 1868					s		x		c	STRIBC 4595, 4596
Klais guimeti (Bourcier, 1843)								c	c	STRIBC 3773, 4591
Phaeochroa cuvierii (DeLattre & Bourcier, 1846)							x		s	
Campylopterus hemileucurus (Deppe, 1830)		X					x		c	STRIBC 4657, 4658
Amazilia edward (De Lattre & Bourcier, 1846)					c	c	x	c	c	ANSP 189190, 189191; UWBM 106481; STRIBC 3729, 4666
Amazilia tzacatl (De la Llave, 1833)					c	c	x		c	UWBM 111295, 112020, 106480; STRIBC 4659, 4660
Hylocharis eliciae (Bourcier & Mulsant, 1846)					c	c	x			ANSP 189189, UWBM 111278
Trogon massena Gould, 1838					c		x			ANSP 187542, 187543
Trogon caligatus Gould, 1838					c		x			ANSP 189160
Trogon rufus Gmelin, 1788					s	c	x		c	STRIBC 4654
Momotus momota (Lesson, 1842)					s		x		s	
Megaceryle torquata (Linnaeus, 1766)					s		x			

Continued

Table 1. *Continued.*

Scientific Name	BirdLife global status	Montane obligate[1]	Migrants	Range extension[2]	1996 Cobachón - Cascajilloso	2004 Restingue	2009 Cobachón	2011 La Bajia	2013 Pavo	voucher specimen number
Chloroceryle americana (Gmelin, 1788)					s	c	x			UWBM 105435
Notharchus hyperrhynchus (Sclater, 1854)					s					
Ramphastos sulfuratus Lesson, 1830					s		x		s	
Melanerpes rubricapillus (Cabanis, 1862)					s		x		s	
Picoides fumigatus (d'Orbigny, 1840)				x	s					
Dryocopus lineatus (Linnaeus, 1766)					s		x			
Campephilus melanoleucos (Gmelin, 1788)					s		x			
Micrastur semitorquatus (Vieillot, 1817)					h		x		h	
Milvago chimachima (Vieillot, 1816)					s		x		s	
Falco sparverius Linnaeus, 1758							x			
Falco rufigularis Daudin, 1800					s		x		s	
Falco peregrinus Tunstall, 1771					s					
Pyrrhura picta eisenmanni Delgado 1985					s		x		s	
Aratinga pertinax (Linnaeus, 1758)									s	
Ara ambiguus Bechstein, 1811	EN				s		x			
Brotogeris jugularis (Muller, 1776)					s		x		s	
Pyrilia haematotis (Sclater & Salvin, 1871)					c					ANSP 187537, 187538 , 187539
Pionus menstruus (Linnaeus, 1766)					s		x			
Amazona farinosa Boddaert, 1783)					s		x			
Taraba major (Vieillot, 1816)					h					
Thamnophilus doliatus (Vieillot, 1816)					c		x		c	ANSP 189180; STRIBC 4627, 4639
Thamnophilus bridgesi Sclater, 1856					c	c	x			ANSP 187544, 187545, 187546, 187547
Myrmotherula schisticolor (Lawrence, 1865)					c				c	ANSP 189164, 189165; STRIBC 4651
Cercomacra tyrannina (Sclater, 1855)									c	STRIBC 4698
Myrmeciza exsul Sclater, 1859					c	c	x	c	h	ANSP 189181; STRIBC 3758
Sclerurus guatemalensis (Hartlaub, 1844)							x			
Synallaxis albescens Temminck, 1823							x			
Sittasomus griseicapillus (Vieillot, 1818)					c	c	x			ANSP 189182, 189183
Dendrocincla homochroa (Sclater, 1859)					s				c	STRIBC 4910
Xiphorhynchus susurrans (Jardine, 1847)					c	c	x		c	ANSP 189185, 189186; STRIBC 4662
Xenops minutus (Sparrman, 1788)					c	c			c	ANSP 189184; STRIBC 4652
Camptostoma obsoletum (Temminck, 1824)					h		x			
Phaeomyias murina (Spix, 1825)							x			
Capsiempis flaveola (Lichtenstein, 1823)							x			
Tyrannulus elatus (Latham, 1790)							x			
Myiopagis viridicata (Vieillot, 1817)					c		x			ANSP 189241
Elaenia flavogaster (Thunberg, 1822)							x			
Elaenia frantzii (Lawrence, 1865)		x			c					ANSP 189239
Mionectes oleagineus (Lichtenstein, 1823)					s	c	x		c	STRIBC 4601, 4603, 4611, 4614, 4612, 4605, 4606, 4592, 4604, 4613.
Leptopogon amaurocephalus (Tschudi, 1846)					c		x			ANSP 189244
Zimmerius vilissimus (Sclater & Salvin, 1859)					c		x			ANSP 189232, 189233

Continued

Table 1. *Continued.*

Scientific Name	BirdLife global status	Montane obligate[1]	Migrants	Range extension[2]	1996 Cobachón - Cascajilloso	2004 Restingue	2009 Cobachón	2011 La Bajia	2013 Pavo	voucher specimen number
Lophotriccus pilaris (Cabanis, 1847)					h	c	x			UWBM 111293
Todirostrum cinereum (Linnaeus, 1766)							x			
Tolmomyias sulphurescens (Spix, 1825)					s		x			
Platyrinchus mystaceus Vieillot, 1818					c		x			ANSP 189238
Terenotriccus erythrurus (Cabanis, 1847)					s					
Myiobius atricaudus Lawrence, 1863					s		x		s	
Contopus cooperi (Nuttall, 1831)	NT		m		s					
Contopus cinereus (Spix, 1825)					s		x		s	
Empidonax flaviventris (Baird & Girard, 1843)			m		c					ANSP 189242, 189243
Empidonax virescens (Vieillot, 1818)			m		c	c				ANSP 189240
Myiarchus tuberculifer (d'Orbigny & Lafresnaye, 1837)					c		x			ANSP 189245
Myiarchus crinitus (Linnaeus, 1758)			m		s	c				
Pitangus sulphuratus (Linnaeus, 1766)					s		x		s	
Megarhynchus pitangua (Linnaeus, 1766)					s		x		c	STRIBC 4600
Myiozetetes similis (Spix, 1825)					s		x		s	
Myiodynastes maculatus (Sclater, 1859)					s		x		s	
Legatus leucophaius (Vieillot, 1818)							x			
Tyrannus melancholicus Vieillot, 1819					s	c	x		s	
Tyrannus savana Vieillot, 1808									s	
Schiffornis stenorhyncha (Sclater & Salvin, 1869)							x			
Tityra semifasciata (Spix, 1825)					s		x		s	
Tityra inquisitor (Lichtenstein, 1823)					c		x			ANSP 20385
Pachyramphus polychopterus Vieillot, 1819					c	c	x			ANSP 189228
Pachyramphus aglaiae Lafresnaye, 1839					c					ANSP 189227
Procnias tricarunculatus (Verreaux &.Verreaux 1853)	VU	X			c			c	s	ANSP 187540, 187541; STRIBC 3722
Corapipo altera (Hellmayr, 1906)					c	c	x		c	ANSP 189177, 189178; UWBM 106744, 111294; STRIBC 4664, 4665
Chiroxiphia lanceolata (Wagler, 1830)					c	c	x		c	ANSP 189168, 189169; UWBM 111277, 111279, 1112780; STRIBC 3755, 4650, 4633, 4625
Ceratopipra mentalis (Sclater, 1888)						c	x			
Manacus aurantiacus (Salvin, 1870)						c				
Vireo flavifrons Vieillot, 1808					s					
Vireo philadelphicus (Cassin, 1851)			m		h	c				
Vireo flavoviridis (Cassin, 1851)					c		x			ANSP 189231
Hylophilus decurtatus (Berlepsch & Taczanowski, 1884)					c	c	x			ANSP 189230; UWBM 111281, 111282
Cyclarhis gujanensis (Gmelin, 1789)					h				c	ANSP 189229; STRIBC 4668
Cyanocorax affinis Pelzeln, 1856					s		x			
Progne chalybea (Gmelin, 1789)					s		x		s	

Continued

Table 1. *Continued.*

Scientific Name	BirdLife global status	Montane obligate[1]	Migrants	Range extension[2]	1996 Cobachón - Cascajilloso	2004 Restingue	2009 Cobachón	2011 La Bajia	2013 Pavo	voucher specimen number
Tachycineta albilinea (Lawrence, 1863)					s					
Stelgidopteryx ruficollis (Vieillot, 1817)					s					
Hirundo rustica Linnaeus, 1758			m		s				c	STRIBC 4667
Troglodytes aedon Vieillot, 1809					s	c	x		s	
Pheugopedius rutilus (Vieillot, 1819)					c		x		c	ANSP 189209, 189210; STRIBC 1477
Thryophilus rufalbus (Lafresnaye, 1845)					c	c	x			ANSP 189220
Cantorchilus modestus (Cabanis, 1861)					c		x		c	ANSP 189211; STRIBC 4631, 4638
Ramphocaenus melanurus Vieillot, 1819					c	c	x			ANSP 189213
Polioptila plumbea (Gmelin, 1788)					c		x			ANSP 189212
Catharus aurantiirostris (Salvin, 1866)		X			c		x			ANSP 189223
Catharus ustulatus (Nuttall, 1840)			m		s				n	
Turdus grayi Bonaparte, 1838					s		x		s	
Turdus assimilis Cabanis, 1850		X			c		x		s	ANSP 189222
Seiurus aurocapilla (Linnaeus, 1766)			m		s				c	STRIBC 4649
Vermivora chrysoptera (Linnaeus, 1766)	NT		m		s					
Mniotilta varia Linnaeus, 1766			m		s					
Protonotaria citrea (Boddaert, 1783)			m		s					
Oreothlypis peregrina (Wilson, 1811)			m		s	c				
Geothlypis philadelphia (Wilson, 1810)			m		c					ANSP 189216
Geothlypis formosa (Wilson, 1811)			m		c	c				ANSP 189215
Setophaga ruticilla (Linnaeus, 1758)			m		s					
Setophaga pitiayumi (Vieillot, 1817)				x	s		x		c	STRIBC 4585
Setophaga castanea (Wilson, 1810)			m		s					
Setophaga fusca (Müller, 1776)			m		s					
Setophaga petechia (Linnaeus, 1766)			m		s					
Setophaga pensylvanica (Linnaeus, 1766)			m		s					
Basileuterus culicivorus (Deppe, 1830)					c		x		c	ANSP 189218; STRIBC 4669
Basileuterus rufifrons (Bonaparte, 1854)					c		x		c	ANSP 189217; STRIBC 4670
Basileuterus aff. *melanogenys*		X		x					c	STRIBC 4593
Myiothlypis fulvicauda (Spix, 1825)						c	x		s	UWBM 111259
Cardellina canadensis (Linnaeus, 1766)			m		c					ANSP 189214
Cardellina pusilla (Wilson, 1811)			m		s					
Coereba flaveola (Linnaeus, 1758)					s					
Rhodinocichla rosea (Lesson, 1832)					c		x		s	ANSP 189224, 189225
Eucometis penicillata (Du Bus de Gisignies, 1855)					s					
Ramphocelus dimidiatus Lafresnaye, 1837							x		n	
Thraupis episcopus (Swainson, 1834)					s		x		s	
Thraupis palmarum (Sclater, 1857)					s		x		s	
Tangara gyrola (Linnaeus, 1758)					c				c	ANSP 189200; STRIBC 4624

Continued

Table 1. *Continued.*

Scientific Name	BirdLife global status	Montane obligate[1]	Migrants	Range extension[2]	1996 Cobachón - Cascajilloso	2004 Restingue	2009 Cobachón	2011 La Bajia	2013 Pavo	voucher specimen number
Tangara larvata (Du Bus de Gisignies, 1846)					c		x		c	ANSP 189198, 189199; STRIBC 4632
Dacnis venusta Lawrence, 1862				x					s	
Chlorophanes spiza (Linnaeus, 1758)					s		x		c	STRIBC 4623
Cyanerpes cyaneus (Linnaeus, 1766)					c		x		c	ANSP 189201, 189202; UWBM 111283; STRIBC 4675
Saltator striatipectus Lafresnaye, 1847							x			
Saltator maximus (Lafresnaye, 1844)					c		x		c	ANSP 189206; STRIBC 4671
Volatinia jacarina (Linnaeus, 1766)							x		s	
Sporophila americana (Gmelin, 1789)									s	
Sporophila nigricollis (Vieillot, 1823)							x			
Oryzoborus funereus Sclater, 1860							x		c	STRIBC 4588
Tiaris olivaceus (Linnaeus, 1766)							x		s	
Arremon aurantiirostris Lafresnaye, 1847					c		x		c	ANSP 189205; STRIBC 4609, 4610, 4615, 4616, 4617, 4618, 4619, 4620, 4621, 4622
Arremonops conirostris (Bonaparte, 1850)					s		x		c	
Atlapetes albinucha (Lafresnaye, 1843)		X							c	STRIBC 4672
Piranga flava (Vieillot, 1822)							x			
Piranga rubra (Linnaeus, 1758)			m		s					
Piranga olivacea (Gmelin, 1789)			m						s	
Piranga leucoptera (Trudeau, 1839)					c					ANSP 189197
Habia rubica (Vieillot, 1817)					c		x		c	ANSP 189203, 189204; STRIBC 4643
Pheucticus ludovicianus (Linnaeus, 1766)			m		s				s	
Cyanocompsa cyanoides (Todd, 1923)					h		x		c	STRIBC 4589
Sturnella magna (Linnaeus, 1758)					s		x	c	s	STRIBC 4319
Quiscalus mexicanus (Gmelin, 1788)							x		s	
Molothrus aeneus (Wagler, 1829)									s	
Icterus chrysater (Cassin, 1848)					h		x		c	STRIBC 4599
Icterus galbula (Linnaeus, 1758)			m		c					ANSP 189208
Psarocolius decumanus (Pallas, 1769)					s		x		s	
Euphonia laniirostris (d'Orbigny & Lafresnaye, 1837)					s	c	x		s	
Spinus psaltria (Say, 1823)							x			
Totals (225 species)	**9**	**10**	**26**	**4**	**170**	**32**	**147**	**6**	**102**	

[1] i.e., found only above 750 m a.s.l.
[2] range extensions include taxa not previously recorded for southern Veraguas or Los Santos provinces.

Dean 2010); molecular systematics of the *Pyrrhura* complex have failed to fully resolve species limits (Ribas et al. 2006). Although geographically range-restricted, this species is surprisingly conspicuous in mid-elevations throughout the area. In addition to habitat loss, a specimen of a probable escaped cage bird from Panama City (STRIBC 0165) suggests that this species is probably also threatened by collection for the local pet trade.

Great Green Macaw (*Ara ambiguus* Bechstein, 1811). In 1996, this species was seen daily flying overhead in small flocks (up to eight individuals) in the Río Cobachón valley, but not in either the coast areas nor higher above (i.e., > 500 m a.s.l.). RSR and D. Agro returned returned to the Cobachón area and were shown by locals a macaw nest in a *Cuipo* growing on a steep ridge. The nest was a natural hollow ca. 20 m above ground level and they heard young vocalizing in the nest. They learned later that the nest was removed by poachers. This species is considered globally Endangered (IUCN 2013) and persists only in isolated populations in remote areas of Panama.

Violet Sabrewing (*Campylopterus hemileucurus mellitus* Bangs, 1902). This species breeds only in montane areas (although it descends to the lowlands outside of the breeding season) and thus the Cerro Hoya population is likely isolated by 150 km from the nearest conspecific population in the Central Cordillera. We observed no phenotypic differences in our voucher specimens.

Mountain-gem sp. nov. (*Lampornis sp. nov.*) In 1996, GRA observed a *Lampornis* hummingbird that he attributed to *L. calolaemus homogenes* (Purple-throated Mountain-gem) found in the western central cordillera of Panama. The 1996 expedition failed to collect a specimen. In 2011, OGL and fellow expedition members collected two males that provided phenotypic, and ultimately genetic evidence, of the distinctiveness of the Cerro Hoya form (Figure 3). In 2013, six additional specimens were obtained, all males showing the distinctive rufous belly and non-iridescent crown traits that separate the Cerro Hoya taxon from *L. calolaemus homogenes*. A full species description is under review. *Lampornis* hummingbirds are tolerant of mixed forest and open habitat, and while the global population of this species is likely small given the available montane habitat in the Azuero Peninsula, the population is likely stable, having last been connected to populations in other montane areas in Panama when lowland temperatures were cooler during the Pleistocene (Piperno et al. 1990). In fact, the loss of montane habitats due to global climate change likely represents the greatest conservation threat to this newly discovered species (e.g., Pounds et al. 1999; Şekercioğlu et al. 2012).

Glow-throated Hummingbird (*Selasphorus ardens* Salvin, 1870). The potential occurrence of a hummingbird of the genus *Selasphorus* in the Cerro Hoya region

Figure 3. Photograph of male *Lampornis sp. nov.* STRIBC 3592 just prior to collection above La Bajía in 2011. Photo credit: OGL.

Figure 4. Photograph of unknown hummingbird near La Bajía taken in 2011. Photo courtesy of Laurencio Martínez.

was first reported by F. Delgado, who claimed to have collected an immature male in 1994 (Collar et al. 1994; Stattersfield et al. 1998; Angehr 2003). Unfortunately, this specimen has not been available for scientific study, and is apparently lost (Delgado pers. comm. to GRA). In 1996, D. Agro reported a glimpse of a possible *Selasphorus ardens*, at 850 masl in oak forest. In early 2011, L. Martínez took a photograph (Figure 4) of a possible *Selasphorus* hummingbird at approximately 1,000 m a.s.l. near La Bajía (photograph coordinates: 07.33° N, 080.66° W). However, certain phenotypic characters of this photographed hummingbird are more similar to *Calliphlox bryantae* Lawrence 1867. The 2011 and 2013 expeditions were done mainly to confirm the existence of *Selasphorus* in the Cerro Hoya highlands. Yet, despite intensive efforts in 2011 and 2013, no individual was observed or collected. Thus, while there is circumstantial evidence that some species of small hummingbird in the "bee" clade (e.g., McGuire et al. 2007) occurs on Cerro Hoya, whether they represent *Calliphlox bryantae*, *Selasphorus ardens*, or (considering the considerable disjunction in range from these two species) even an

undescribed hummingbird species remains to be determined. Notably, species in the bee hummingbird clade, such as *Selasphorus* and *Calliphlox* prefer open montane habitats, yet MJM observed closed forest canopy at 1,375 m a.s.l. above Pavo, near the summit. This may indicate that little suitable habitat for species of "bee" clade hummingbirds occurs on Cerro Hoya. Unless a specimen is collected and deposited in a formal natural history collection, we recommend removing *Selasphorus* from the list of species occurring in Cerro Hoya.

Yellow-bellied Sapsucker (*Sphyrapicus varius* [Linneus, 1766]). A non-breeding migrant from North America, this species was previously known only from the western Caribbean lowlands and occasionally the western highlands of Panama. Our record represents the first record of this species from not only the Azuero Peninsula, but all the Pacific slope of Panama.

Smoky-brown Woodpecker (*Veniliornis fumigatus* [d'Orbigny, 1840]). Only found during the 1996 expedition, when it was rare, being seen and heard at 650 m a.s.l. This represents a range extension for this species, which was previously unknown from the Azuero Peninsula. It would be a priority to collect specimens of this species, as it is a montane endemic that deserves further scrutiny given that the closest conspecific population is in the central cordillera.

Mountain Elaenia (*Elaenia frantzii frantzii* [Lawrence, 1865]). A lone individual was collected during the 1996 expedition. Previously, this species was unknown from the Azuero Peninsula, with the nearest conspecific population occurring in the central cordillera.

Three-wattled Bellbird (*Procnias tricarunculatus* [Verreaux & Verreaux, 1853]). Considered globally Vulnerable (IUCN 2013), Three-wattled Bellbirds were heard consistently throughout the day above 950 m a.s.l. by the 2013 team. This species is known to have microgeographic variation in vocalizations. To our ear, the call type sounded different from that heard in the Talamanca highlands. More detailed studies should be undertaken to compare this population's vocal characteristics to that of the Talamanca highlands and the population on the upper reaches of Isla Coiba that have also been recently discovered to vocalize and are probably nesting (GRA pers. obs.). More detailed work on the population structure of Three-wattled Bellbirds is warranted, and should include the population of Cerro Hoya.

Orange-billed Nightingale-Thrush (*Catharus aurantiirostris griseiceps* Salvin, 1866). Although this montane taxon is isolated by 150 km from conspecifics in the central cordillera of Panama, our lone male specimen is indistinguishable from a series of specimens from Chiriquí and Veraguas.

Tropical Parula (*Setophaga pitiayumi speciosa* [Ridgway, 1902]). Based on the range map in Angehr and Dean (2010) as well as the species description in Wetmore et al. (1984), this species is unknown from the Azuero Peninsula. Our lone specimen appears assignable to the *S. p. speciosa*, subspecies previously known from the Talamanca highlands, rather than *S. p. cirrha* Wetmore 1957, endemic to Isla Coiba, which is perhaps surprising, given the geographic proximity of Coiba and the number of lowland bird taxa shared between Isla Coiba and Cerro Hoya such as *Leptotila battyi*.

Undescribed wood-warbler taxon (*Basileuterus taxon novum***).** A single specimen of a distinctive form of *Basileuterus* of the B. *melanogenys-ignota* species complex was collected during the 2013 expedition at 1,300 m a.s.l. in closed lower montane forest; several other individuals were observed. The specimen is phenotypically more similar to *B. ignotus* Nelson, 1912 in plumage than to the geographically closer taxa of western Panama (*B. m. eximius* Nelson, 1912 and *B. m. bensoni* Griscom, 1927). A genetic study of relationships in this group is pending.

White-winged Tanager (*Piranga leucoptera* Trudeau, 1839). A single male was collected during the 1996 expedition. Prior to this collection, this montane-obligate species was unknown from the Azuero Peninsula, with the closest conspecific population occurring in the central cordillera roughly 150 km to the north. Other males were observed during the 2009 and 2013 expeditions.

White-naped Brush-Finch (Azuero) (*Atlapetes albinucha azuerensis* Aldrich & Boyle, 1937). A single specimen of this poorly known and distinctive subspecies was collected in 2013. First described by Aldrich and Boyle (1937), a sole specimen was collected on Cerro Hoya in 1962 by C.O. Handley's team (Wetmore et al. 1984). As far as we know, this taxon has not been collected since.

DISCUSSION

Our species list for Cerro Hoya represents the most comprehensive species list for any site in the Azuero Peninsula and also the Pacific lowlands of Panama. Because of its topographic and habitat diversity, and because it contains the largest remaining areas of moist lowland and montane forests, Cerro Hoya National Park has the highest bird species richness of any area in the Azuero Peninsula. For example, Lasky and Keitt (2007) recorded only 71 species of birds from a survey of five dry forest fragments scattered throughout the Azuero Peninsula, although this survey, like our survey of Cerro Hoya, is likely incomplete. The presence of several species of large-bodied birds such as *Crax rubra* and *Ara ambiguus* provide further evidence that the avian community of Cerro Hoya is relatively intact and complete and has considerable conservation value.

While our list is based on the results of five expeditions, the relatively low numbers of migratory passerines, birds of prey, and nocturnal birds was lower than reasonably expected for a complete Panamanian

site checklist (Angehr et al. 2006). Because our final expedition recovered several montane species that were unrecorded in prior expeditions, we believe that additional montane species remain to be discovered on Cerro Hoya. We urge continued ornithological activity in the region, especially at its highest elevations.

Nonetheless, based on the overall composition of our species list, it is likely that overall avian species richness is substantially lower than our estimates for many Panamanian National Parks, typically 300 to 500 species (e.g., Karr 1990; Angehr et al. 2006). Some of this is due to the general trend of lower bird species richness in more seasonal, drier lowlands of the Pacific Panama relative to the wetter, less seasonal Caribbean forests (Karr 1976; Ridgely and Gwynne 1989). Furthermore, while our sampling of montane species may be incomplete, it is clear than overall species richness of highland species in Cerro Hoya is substantially lower than that of the central cordillera, which can be explained by both the common biogeographical phenomenon of decreasing species richness towards the tips of peninsulas (Simpson 1964) along with the island biogeographic phenomenon of montane forest sky island habitats (islands of montane forest habitat isolated by inhospitable lowland habitats; e.g., Warshall 1995).

While sky-island biogeography leads to lower overall species richness, it can result in elevated levels of endemism in montane taxa (Warshall 1995). Of the ten confirmed montane-obligate bird species on Cerro Hoya, four are endemic taxa at either the species or subspecies level. Such a high proportion of endemic fauna highlights the evolutionary distinctiveness of the Cerro Hoya avifauna, which provides an extremely strong argument for increased conservation attention in the region.

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